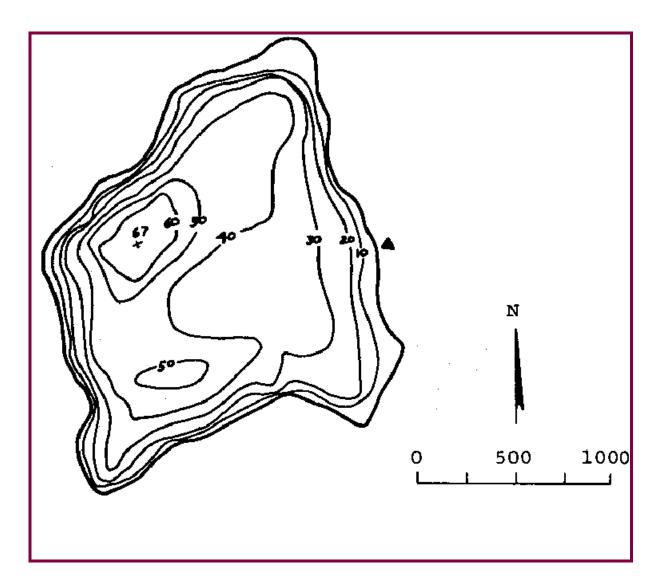
Lake ID: WARTH1

Ecoregion: 2

Ward Lake is located 2.5 miles south of Olympia, in a kettle depression. It is spring-fed, and has no surface outlets. It is within the Deschutes River watershed.

Area (acres)	Maximum Depth (ft)		
65	67		
Volume (ac-ft)	Shoreline (miles)		
\ 3 /	Sitoi ettite (iitties)		

Mean Depth (ft)	Drainage (sq mi)		
33		1	
Altitude (ft abv msl)	Latitude	Longitude	
123	47 00 21.	122 52 36.	



Station Information

WARTH1

Primary Station Station # 1 latitude: 47 00 26.3 longitude: 122 52 44.2

Description: Deep part of lake directly west of boat launch about 500 feet east of west

shore

Trophic State Assessment for 1998

WARD

Analyst: KIRK SMITH

TSI_Secchi: 40
TSI_Phos: 34
TSI_Chl: 37
Narrative TSI:^a OM

About 60% of Ward Lake's shoreline is densely residential, the rest is undeveloped. The watershed is very small. The lake shows many characteristics of an oligotrophic lake (mean total phosphorus was 8.8 ug/L) but its late summer anoxic hypolimnion, significant internal loading, and noticeable algal blooms are more indicative of a mesotrophic lake. We have assigned an oligo-mesotrophic assessment. There were only two user surveys returned for Ward Lake and we cannot draw conclusions based on so few questionnaires. However, Ward Lake has been included in the LWQA program for many years and its uses have remained fairly constant during that time. The lake is primarily used by residents for swimming. The boat launch is frequented by fishermen who fish the lake primarily for kokanee and trout. The lake supports a very popular and healthy kokanee fishery. The habitat survey suggests there is abundant aquatic vegetation growth in the shallow portions of the lake near the shore. The survey also indicates that human influences on the shoreline include lawns and buildings. The substrate is mostly silt. The lake may be subjected to watershed impacts from runoff of lawn fertilizers and a nearby plant nursery. Algal blooms in 1998 produced a very green lake at times which is unusual for Ward Lake, though chlorophyll concentrations were still low to moderate. However, with the exception of a high fecal bacteria count in June, it appears that all the beneficial uses of the lake are still supported by the present water quality conditions.

Therefore, we recommend the nutrient criterion for Ward Lake be set at the ecoregional action value for oligotrophic Puget Lowland lakes, 10 ug/L total phosphorus.

^a E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

<u>Chemis</u>	<u>stry Data </u>					WARD
Date	Time Strata	Tot P Tot N (ug/L) (mg/L) TN:TP	phyll	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Turbidity (NTU)
Station 0						
6/1/1998	L			7		

	L					240 J			
7/23/1998	L					6			
	L					3			
8/10/1998	L					11			
9/24/1998	L					4			
Station 1									
6/1/1998	E	10.9	.156	14	2		5	1290	.6
	Н	56.2	.366	7					
7/23/1998	E	9.1	.246	27	1.9				1.3
	Н	116	.393	3					
8/10/1998	Е	7.8	.222	28	1.5				.6
	Н	294	.726	2					
9/24/1998	E	7.4	.237	32	2.6				.6
	Н	377	.972	3					

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than

Watershed Survey		WARD
	Survey Date:	9/24/1998
Land Uses (1 = Primary, 2 = Secondary, etc.)		
Agriculture(commercial, not hobby)	1 Residential	
2 Commercial, Industrial	Park, forest or natura	l
3 Major transportation	,	
Impervious surfaces (Roads and parking area): Partially	Curbed	
Observations (check mark denotes presence)		
BMP's		
Odors		
Cattle Ducks Geese		
None		
Fertilizers and weed killers appear to be used in resident	tial or agriculture area \Box	
Yes. Green lawns evident along lakeshore and watershed.		
Buffer zones around streams and wetlands ✓		
Lots of riparian habitat along lakeshore.		
Irrigation 🗹		
Southwest end of lake		

Habitat Survey Summary Report

Habitat Survey Sumn	nary Report		WARD
	ations Surveyed	Date of Visit:	7/6/1998
Vegetation Type (Avg. o	only of sites w/ vegetation present; 1=conif	erous, 3=decidu	ous)
Canopy Layer Avg:	1.9 Number of stations with canopy:	10	
Understory Avg:	2.7 Number of stations with understory	y : 10	
Percent Areal Coverage	0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%	o, 4 = >75%)	
Canopy Layer:	trees > 0.3 m DBH	1.5	
	trees< 0.3 m DBH	1.0	
Understory:	woody shrubs saplings	1.9	
	tall herbs, forbs grasses	1.1	
Ground Cover:	woody shrubs seedlings	1.1	
	herbs, forbs, grasses	1.1	
	standing water or inundated veg	1.4	
	barren or buildings	0.8	
Substrate Type	bedrock	0.0	
(within shoreline plot):	boulders	0.0	
	cobble/gravel	0.4	
	loose sand	0.4	
	other fine soil/sediment	1.4	
	vegetated	3.1	
	other	0.9	
Bank Features:	angle (O:<30; 1: 30-75; 2:nr vertical)	0.6	
	vertical dist (M from wtrln to high wt):	0.1	
	horiz. dist. (M from wtrln to high wt):	0.3	
Human Influence	(0 = absent, 1 = adjacent to or behind plot, 2 =	present within plo	t)
	buildings	1.2	
	commercial	0.0	
	park facilities	0.1	
	docks/boats	1.4	
	walls, dikes, or revetments	0.7	
	litter, trash dump, or landfill	0.0	
	roads or railroad	0.0	
	row crops	0.0	
	pasture or hayfield	0.0	
	orchard	0.0	
	lawn	1.2	

other 0.3

Physical Habitat Characteristics

station depth (at 10 m from shore)

4.8

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0
boulders	0.0
cobble	0.0
gravel	0.0
sand	0.2
silt	1.7
woody debris	0.5

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	1.3
emergent	0.7
floating	1.9
total weed cover	2.3
Do macrophytes extend lakeward $(-1 = yes, 0 = no)$	

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	1.7
snags	0.1
brush or woody debris	1.0
inundated live trees	0.4
overhanging vegetation	0.9
rock ledges or sharp dropoffs	0.0
boulders	0.0
human structures	0.8

Questionnaire WARD

Results compiled from 1 Surveys. Average time (years) respondents spent on lake:

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:

Public Access:

1.0 Swim Beach:

Water Clarity:

Water Qual. for Swim:

Fishing Quality:

1.0 Aquatic Plants:

Distance to Lake:

Canada Geese:

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today?

Which would you rather have, 1 or 2?

- 1) Better fishing and more natural habitat, or 2) clearer water?
- 1) Better fishing and more natural habitat, or 2) fewer aquatic plants?
- 1) Clearer water or 2) fewer aquatic plants?

ID Date 3 6/6/1998 Visitor	Residency	Own Activity*		Factor? Changed? W	/hen?
Survey		Rent or Primary		Water Clarity Purchase Has it	
Tabulated Results					
Good Coldwtr Fishing:	5.0	Clear Water:	5.0		
No Odors:	5.0	Public Access:	3.0		
Natural Shoreline:	3.0	Less Algae:	5.0	Canada Geese:	1.0
Plant Growth:	3.0	Good Swimming:	1.0	Public Beach:	3.0
Restricted Watercraft:	3.0	Good Warmwtr Fishing:	1.0	Natural Scenery:	4.0

^{* 1=}canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

WARTH1

Date 6/1/19	998 Station: 1 Sample ID_10	4 mLs observed
Number of organ	isms measured: 93	
Group	Percent	Group Percent
Cladoceran	14.0%	Small < 1mm 55.9%
Copepod	86.0%	Large >= 1mm 44.1%
Other		Ratio of large to Small: 0.79
		Average size (mm): 0.82

Aquatic Plant Data

WARD

Sampler: Parsons, O'Neal Max depth of growth (M): 6

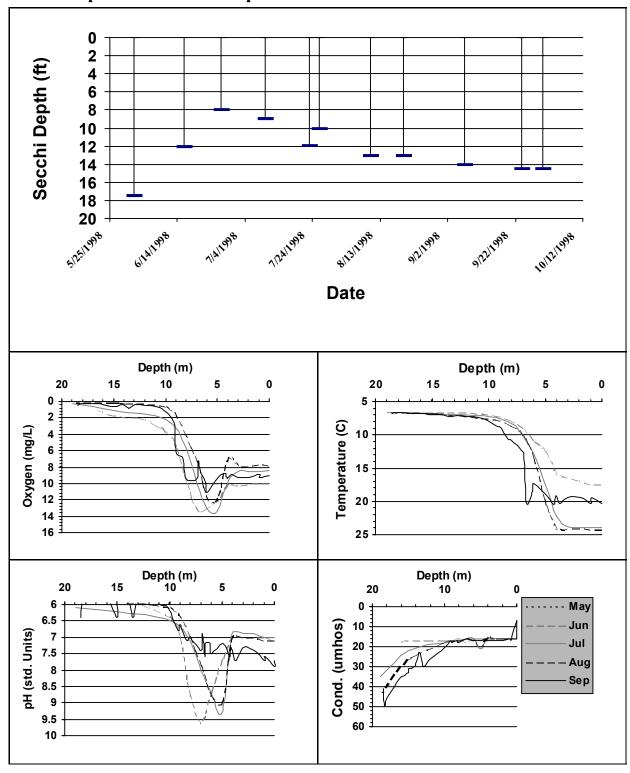
Survey Date: 7/6/1998

Comments partly cloudy, light breeze, bullfrogs, sparse plant cover - mostly Nymphaea. Shoreline drops steeply in most areas, plant community pretty homogeneous. Conducted habitat survey for Kirk Smith.

SPECIES LIST			
Scientific Name	Common Name	Dist ^a	Comments
Callitriche stagnalis	pond water-starwort	1	
Iris pseudacorus	yellow flag	2	
Juncus sp. or Eleocharis sp.	small grass-like plants	1	
Nitella sp.	stonewort	3	common in deep water, though not dense
Nuphar polysepala	spatter-dock, yellow water-lily	1	only saw 1 in flower
Nymphaea odorata	fragrant waterlily	3	present along most of shore to approx. 3 m deep
Scirpus sp.	bulrush	2	
Typha sp.	cat-tail	2	
Utricularia sp.	bladderwort	1	

- a 0 value not recorded (plant may not be submersed)
 2 few plants, but with a wide patchy distribution
 4 plants in nearly monospecific patches, dominant

- 1 few plants in only 1 or a few locations
 3 plants in large patches, codominant with other plants
 5 thick growth covering substrate to exclusion of other species



Date	Time	Temp- erature (F)		Color (1-greens, 11-browns	Bright- ness (pct)	(1-none,	Rainfall (0-none, 5-heavy)	(1-bad, 5-	Swimming (1-poor, 5- good)		Waterfowl (besides geese #)	Boats- Fishing (#)	Boats- Skiing (#)
Station 1													
6/1/1998			17	6	100	2		5	5	0	2	2	0
	Sample	er: SMITH		Remarks		OW DOWN T L WATERSHE		S AT DEEP SITE	E. HIGHLY RES	SIDENTIA	L APPROX 40%	SHORELINE	NATURAL.
6/1/1998		17.5	17.5	3	75	2	1	5	5	10	6	4	0
	Sample	er: CLOUD		Remarks	3:								
6/1/1998			17.5		0					0	0	0	0
	Sampler: BELL-MCKINNON			Remarks	3:								
6/16/1998		21	12	3	0	2	2	5	4	0	0	1	0
	Sample	er: CLOUD		Remarks	s: BLOO AGO.	M STARTING	- MUCH CLI	EARER 4 DAYS					
6/27/1998		19	8	4		1	2	5	4	30	1	1	0
	Sample	er: CLOUD		Remarks	3:								
7/10/1998		22	9	3	50	1	1						
	Sample	er: CLOUD		Remarks	3:								
7/23/1998			11.88	2	100			4	4	0	7	2	0
	Sample	er: SMITH		Remarks	S: H2S IN HYPO	N THE LIMNION							
7/26/1998		25	10	7	0	1	1	5	4	0	0	2	0
,,_,,,,		er: CLOUD		Remarks									
8/10/1998			16.83	2	80			5	5	9	9	0	0
	Sample	er: SMITH		Remarks		EN WAS INCI LIMNION	REDIBLY LO	W IN					
8/10/1998		26	13	8	0	1	1	5	5	0	4	0	0
	Sample	er: CLOUD		Remarks									

Date		Temp- erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright- ness (pct)	Wind (1-none, 5-gusty)	,	Aesthetics (1-bad, 5- good)	Swimming (1-poor, 5- good)	Geese (#)	Waterfowl (besides geese #)	Boats- Fishing (#)	Boats- Skiing (#)
8/20/1998		26	13	8	0	2	1	5	5	3	4	2	0
	Sampler: CLOUD			Remark	s:								
9/7/1998		26	14	9	0	1	1	5	5	0	2	2	0
	Sampler:	CLOUD		Remark	s:								
9/24/1998			14.52	2	100	3		4	5	0	26	1	0
	Sampler:	SMITH		Remark			RATING THR ng QA/QC red		GREBES TOO.	The Condu	ectivity result is q	ualified as an	estimate due
9/30/1998		19	14.5	3	0	2	1		5	10	0	0	0
	Sampler:	CLOUD		Remark	s:								
9/30/1998			14.5		0					0	0	0	0
	Sampler: BELL-MCKINNON			N Remark	s:								